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Patent Application of  
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For

### A VESSEL FOR CONTACTING FLUID PHASES

#### FIELD OF THE INVENTION

The present invention relates to a vessel for contacting fluid phases consisting of a fluid guiding body shaped as an auger with a stem and a hollow blade, confined within a housing. The invention especially relates to a vessel wherein a stream of vapor or gas is contacted with a liquid to transfer mass within the vapor or gas stream into the liquid stream or to transfer heat to or from the vapor or gas. A liquid enters the hollow blade through a liquid inlet opening. A vapor or gas enters the conduit formed by the blade of the auger shaped fluid guiding body revolved about the stem and the inside wall of the housing through an inlet opening in the housing. The vapor or gas moves through the conduit and is contacted throughout the contacting zone by the liquid exiting the blade through perforations in the bottom of the blade. The contacted vapor or gas and the used liquid are discharged separately through a vapor or gas discharge opening and a liquid discharge opening, respectively.

#### BACKGROUND OF THE INVENTION

Numerous mechanisms have been devised to contact and subsequently separate a

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Typically, the vapor or gas and liquid flow countercurrently to one another and the frictional drag between the flowing phases and devices such as splash plates, spray nozzles, or mesh screens disperse the liquid into very small droplets to promote mixing of the phases.

Muhr 6 117 219 describes an arrangement for washing and humidifying air with water using a water guiding body shaped as a hollow stone sculpture. The inside and outside surfaces of the body are completely wetted by distributing the downward flow of the water over the inside and outside surfaces of the body using crevices and grooves in the surfaces of the body to maximize the surface area between the air and water phases so as to promote the transfer of water between the phases. Splash plates on the inner surface of the hollow body and an insert body comprised of wire mesh or perforated disks disintegrate the water flowing downward into small droplets to promote mixing of the air and water phases.

Sykes 2 817 415 describes a vertically disposed cylindrical tower type of apparatus for countercurrently contacting fluid phases which uses a helical baffle to direct liquid downward and toward the center of the tower to promote mixing of the liquid within the vortex of a vapor flowing through a helical pathway upward through the contacting zone. Other vertically disposed cylindrical towers utilizing devices such as contacting materials, splash plates, spray nozzles, and perforated surfaces within the vessel to promote contacting of the vapor and liquid phases are common. Generally the vapor or gas makes a single pass through the contacting zone. Throughout most of the contacting zone the vapor or gas is contacted by liquid that has contacted preceding vapor or gas.

#### OBJECT OF THE INVENTION

The objects of the present invention are to thoroughly contact a gas or vapor with a clean liquid throughout a fluid contacting zone, to increase the residence time of a vapor or gas within a cleaning vessel, to improve the scalability of a fluid contacting and separation vessel, and to reduce the cost to produce such a vessel.

#### SUMMARY OF THE INVENTION

The present invention achieves these objectives by a fluid contacting vessel containing an auger shaped fluid guiding body comprising a stem and a blade extending

conduit formed by the blade revolved about the stem through a conduit in the housing at the vapor or gas inlet end of the vessel and flows upward along a helical flow path through the conduit and exits the vessel.

Liquid enters the hollow blade of the fluid guiding body through a conduit in the blade at the liquid inlet side of the vessel and is discharged through perforations in the bottom of the blade into the vapor or gas stream moving through the vessel. The used liquid flows down the upper surface of the blade of the fluid guiding body and is discharged from the vessel. This configuration for contacting a vapor or gas stream with a liquid ensures that the vapor or gas passing through the vessel is contacted thoroughly with clean liquid throughout the fluid contacting zone.

Because the liquid is dispersed thoroughly into the vapor or gas from the perforations in the bottom of the blade, there is no need to operate in a countercurrent manner or to employ devices such as splash plates or spray nozzles to disperse the liquid into the vapor or gas stream. The perforations in the bottom of the blade of the fluid guiding body may be small so as to deliver a fine mist to the vapor or gas stream so that fine matter contained within the stream is wetted and so that heat may be transferred to or from the vapor or gas phase. The perforations may be larger in order to deliver larger liquid droplets to the vapor or gas phase so that wet fine matter within the vapor or gas is contacted by larger liquid droplets and is transferred from the vapor or gas stream to the used liquid stream. The perforations may be designed to deliver the liquid to the vapor or gas phase in a generally concurrent or generally countercurrent manner.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood by referring to the attached figures wherein an embodiment of the invention is illustrated.

FIG. 4 shows a partially cut-away view of an embodiment of the present invention.

FIG. 2 is a view taken along the section I-I of FIG. 4.

FIG. 7 is a view taken along the section II-II of FIG. 4.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 4, the fluid guiding body contains a stem 18 and a continuous hollow blade 20 throughout most or all of the length of the stem 18 wherein the revolutions of the blade 20 about the stem 18 form a conduit 22. The inner edge of the blade 20 continuously contacts the outer surface of the stem 18 and the outer edge of the blade 20 is continuously adjacent to the inner surface of the housing 3, as is indicated in the figures. The vessel housing 3 is cylindrical and contains a structure 5 to support the fluid guiding body.

To simplify the description, it will be considered that the vessel presented by the figures is operated on a gas phase of air and a liquid phase of water. Air enters the vessel through a vapor or gas inlet 30 in the wall of the housing 3 at the air inlet side of the vessel and moves through the contacting zone via the conduit 22 and exits the vessel.

Water enters the blade 20 through a liquid inlet 34 in the blade 20. The blade 20 is hollow and the top of the blade 20 is solid and the bottom of the blade 20 has perforations 24 so that water flows from the blade 20 into the conduit 22 by the forces of gravity and the pressure of the water within the blade 20.

The blade 20 terminates in a horizontal revolution of the blade 20 about the stem 18 which rests upon the support 5 of the housing 3 and has grates 28 so that used water is discharged from the vessel.

The vessel can improve the scalability of a fluid contacting vessel, increase the period of time a vapor or gas is contacted with a liquid, and contact the vapor or gas with clean liquid throughout the contacting cycle.

The present invention can be used in many applications with the appropriate changes in the dimensions, materials of construction, and the configuration of the vessel. Although the description above contains specifications, these should not be construed as limiting the scope of the invention but as merely providing an illustration of an embodiment of the invention.

The dimensions of the vessel including the height and diameter of the vessel housing, the diameter of the stem, and the inside and outside diameters of the blade may be changed to account for the desired flow rate of the vapor or gas through the vessel.

The number of revolutions of the blade about the stem of the auger shaped fluid guiding body can be increased so that the period of time that the vapor or gas is within the contacting zone is increased.

Vapor or gas and liquid streams may enter and exit the vessel at other points within the vessel. The stem of the auger shaped fluid guiding body may be solid or it may have a central hollow core through all or part of its length.

The liquid may be warmer or cooler than the vapor or gas so that heat is transferred to or from the vapor or gas.

The blade of an auger shaped fluid guiding body may be solid with perforations with a liquid introduced onto the blade and entering the conduit through the perforations in the blade, or the blade may be hollow with the top of the blade being solid and the bottom of the blade being perforated with liquid introduced into the blade and entering the conduit through perforations in the bottom of the blade as shown in the drawings